

Formula

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

Additional Information from the Formula Sheet

\bar{x} = sample mean

n = size of the sample

s = sample standard deviation (i.e., the sample-based estimate of the standard deviation of the population)

Record your calculated SEM values in the table given below.

(nearest hundredth)

| | # of Na ⁺ ions entering the TTX nerve cells | # of Na ⁺ ions entering the normal nerve cells |
|----------------------|--|---|
| $SE_{\bar{x}}$ (SEM) | $\frac{3.54}{\sqrt{5}} = 1.58$ | $\frac{5.36}{\sqrt{5}} = 2.40$ |

4. Next you will calculate the **95% confidence limit**.

Formula

There is no formula given on the test, but if you are asked to use the 95% confidence limit to draw error bars on a graph, they will tell you that the 95% confidence limit includes all values within the following range...

$$95\% \text{ CI} = \text{Mean} \pm 2\text{SEM}$$

Why use this formula?

The (mean + 2SEM) gives you the **error bar upper limit** (the top of the error bar). The (mean - 2SEM) gives you the **error bar lower limit** (the bottom of the error bar). The error bar provides a range of values around the mean for this sample of data. If we sampled a much larger number of data points (in this case, more trials of TTX and normal nerve cells), we would be 95% confident that the mean of this larger sample was within the error bar range.

Record your calculated error bar upper limits in row 1 of the table below, and record your calculated error bar lower limits in row 2 of the table below.

(nearest hundredth)

| | # of Na ⁺ ions entering the TTX nerve cells | # of Na ⁺ ions entering the normal nerve cells |
|-----------------------|--|---|
| Error Bar Upper Limit | $7 + 2(1.58) = 10.16$ | $66 + 2(2.40) = 70.80$ |
| Error Bar Lower Limit | $7 - 2(1.58) = 3.84$ | $66 - 2(2.40) = 61.20$ |

5. In the grid given on the next page, create a bar graph showing the mean # of Na⁺ ions entering TTX vs. normal nerve cells. (You should be graphing only two bars.) For each set of data, please graph an error bar using the error bar upper limit and error bar lower limit. Make sure to include the following elements of a proper scientific graph.

- A title that includes information about the x and y axis
- X and Y axis labels (with units where applicable)
- An appropriate scale on your X and Y axes